CLAIMS

What is claimed is:

1. A system for simulating a disease control parameter such
    that a future disease control parameter value $X(t_j)$ at
    time t_j is determined from a prior disease control
    parameter value $X(t_i)$ at time t_i based on an optimal
    control parameter value $R(t_j)$ at time t_j, the difference
    between said prior disease control parameter value $X(t_i)$
    and an optimal control parameter value $R(t_i)$ at time t_i,
    and a set of differentials between patient self-care
    parameters having patient self-care values $S_M(t_i)$ at time
    t_i and optimal self-care parameters having optimal self-
    care values $O_M(t_i)$ at time t_i, said differentials being
    multiplied by corresponding scaling factors K_M, said
    system comprising:

    a) an input means for entering said patient self-care
        values $S_M(t_i)$;

    b) a memory means for storing said optimal control
        parameter values $R(t_i)$ and $R(t_j)$, said prior disease
        control parameter value $X(t_i)$, said optimal self-care
        values $O_M(t_i)$, and said scaling factors K_M;

    c) a processor means in communication with said input
        means and said memory means for calculating said
        future disease control parameter value $X(t_j)$; and

    d) a display means for displaying said future disease
        control parameter value $X(t_j)$.

2. The system of claim 1, wherein said processor means
    calculates said future disease control parameter value
    $X(t_j)$ according to the equation:

$$X(t_j) = R(t_j) + (X(t_i) - R(t_i)) + \sum_M K_M(S_M(t_i) - O_M(t_i)).$$

3. The system of claim 1, further comprising a recording means in communication with said processor means for recording an actual control parameter value $A(t_i)$ at time t_i, an actual control parameter value $A(t_j)$ at time t_j, and actual self-care parameters having actual self-care values $C_M(t_i)$ at time t_i, and wherein said processor means further comprises means for adjusting said scaling factors K_M based on the difference between said actual control parameter value $A(t_j)$ and said optimal control parameter value $R(t_j)$, the difference between said actual control parameter value $A(t_i)$ and said optimal control parameter value $R(t_i)$, and the difference between said actual self-care values $C_M(t_i)$ and said optimal self-care values $O_M(t_i)$.

4. The system of claim 3, wherein said recording means comprises a measuring means for producing measurements of said actual control parameter values $A(t_i)$ and $A(t_j)$.

5. The system of claim 1, wherein said input means further comprises means for entering a value of a physiological parameter of a patient and said processor means further comprises means for determining at least one of said scaling factors from said value of said physiological parameter.

6. The system of claim 5, wherein said physiological parameter is selected from the group consisting of a body mass, an insulin sensitivity, a metabolism rate, and a fitness level.

7. The system of claim 1, wherein said disease control parameter comprises a blood glucose level.

8. The system of claim 7, wherein at least one of said patient self-care parameters is selected from the group consisting of a food exchange, an insulin dose, and an exercise duration.

9. The system of claim 1, wherein said input means, said memory means, and said processor means are operated on a stand-alone computing device.

10. The system of claim 1, wherein said input means, said memory means, and said processor means are operated on a plurality of computers communicating over a network.

11. The system of claim 1, wherein said input means, said memory means, and said processor means comprise a patient multi-media processor and a healthcare provider computer communicating with said patient multi-media processor via a smart card.

12. A system for predicting an effect of patient self-care actions on a disease control parameter such that a future disease control parameter value $X(t_j)$ at time t_j is determined from an actual disease control parameter value $A(t_i)$ at time t_i based on an optimal control parameter value $R(t_j)$ at time t_j, the difference between said actual disease control parameter value $A(t_i)$ and an optimal control parameter value $R(t_i)$ at time t_i, and a set of differentials between patient self-care parameters having patient self-care values $S_M(t_i)$ at time t_i and optimal self-care parameters having optimal self-care values $O_M(t_i)$ at time t_i, said differentials being multiplied by corresponding scaling factors K_M, said system comprising:

   a) an input means for entering said actual disease
       control parameter value $A(t_i)$ and said patient self-
       care values $S_M(t_i)$;

   b) a memory means for storing said optimal control
       parameter values $R(t_i)$ and $R(t_j)$, said optimal self-
       care values $O_M(t_i)$, and said scaling factors K_M;

   c) a processor means in communication with said input
       means and said memory means for calculating said
       future disease control parameter value $X(t_j)$; and

   d) a display means for displaying said future disease
       control parameter value $X(t_j)$.

13. The system of claim 12, wherein said processor means
    calculates said future disease control parameter value
    $X(t_j)$ according to the equation:

$$X(t_j) = R(t_j) + (A(t_i)-R(t_i)) + \sum_M K_M(S_M(t_i)-O_M(t_i)).$$

14. The system of claim 12, wherein said input means
    further comprises means for entering an actual control
    parameter value $A(t_j)$ at time t_j and actual self-care
    parameters having actual self-care values $C_M(t_i)$ at
    time t_i, and wherein said processor means further
    comprises means for adjusting said scaling factors K_M
    based on the difference between said actual control
    parameter value $A(t_j)$ and said optimal control
    parameter value $R(t_j)$, the difference between said
    actual control parameter value $A(t_i)$ and said optimal
    control parameter value $R(t_i)$, and the difference
    between said actual self-care values $C_M(t_i)$ and said
    optimal self-care values $O_M(t_i)$.

15. The system of claim 14, further comprising a
    measuring means connected to said input means for

producing measurements of said actual control
parameter values $A(t_i)$ and $A(t_j)$.

16. The system of claim 12, wherein said input means
further comprises means for entering a value of a
physiological parameter of a patient and said
processor means further comprises means for
determining at least one of said scaling factors from
said value of said physiological parameter.

17. The system of claim 16, wherein said physiological
parameter is selected from the group consisting of
a body mass, an insulin sensitivity, a metabolism
rate, and a fitness level.

18. The system of claim 12, wherein said disease control
parameter comprises a blood glucose level.

19. The system of claim 18, wherein at least one of
said patient self-care parameters is selected from
the group consisting of a food exchange, an
insulin dose, and an exercise duration.

20. The system of claim 12, wherein said input means, said
memory means, and said processor means are operated on
a stand-alone computing device.

21. The system of claim 12, wherein said input means, said
memory means, and said processor means are operated on
a plurality of computers communicating over a network.

22. The system of claim 12, wherein said input means, said
memory means, and said processor means comprise a
patient multi-media processor and a healthcare

provider computer communicating with said patient
multi-media processor via a smart card.

23. A method for simulating a disease control parameter in a
simulation system such that a future disease control
parameter value $X(t_j)$ at time t_j is determined from a
prior disease control parameter value $X(t_i)$ at time t_i
based on an optimal control parameter value $R(t_j)$ at time
t_j, the difference between said prior disease control
parameter value $X(t_i)$ and an optimal control parameter
value $R(t_i)$ at time t_i, and a set of differentials between
patient self-care parameters having patient self-care
values $S_M(t_i)$ at time t_i and optimal self-care parameters
having optimal self-care values $O_M(t_i)$ at time t_i, said
differentials being multiplied by corresponding scaling
factors K_M, said simulation system comprising a memory, a
processor connected to said memory, a display connected
to said processor, and an input means for entering in
said processor said patient self-care values $S_M(t_i)$, said
method comprising the following steps:

a) storing in said memory said optimal control parameter
   values $R(t_i)$ and $R(t_j)$, said prior disease control
   parameter value $X(t_i)$, said optimal self-care values
   $O_M(t_i)$, and said scaling factors K_M;

b) entering in said processor said patient self-care
   values $S_M(t_i)$;

c) calculating in said processor said future disease
   control parameter value $X(t_j)$; and

d) displaying said future disease control parameter value
   $X(t_j)$ on said display.

24. The method of claim 23, wherein said future disease
control parameter value $X(t_j)$ is calculated according
to the equation:

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$$X(t_j) = R(t_j) + (X(t_i) - R(t_i)) + \sum_M K_M (S_M(t_i) - O_M(t_i)).$$

25. The method of claim 23, further comprising the steps of recording an actual control parameter value $A(t_i)$ at time t_i, an actual control parameter value $A(t_j)$ at

10   time t_j, and actual self-care parameters having actual self-care values $C_M(t_i)$ at time t_i and adjusting said scaling factors K_M based on the difference between said actual control parameter value $A(t_j)$ and said optimal control parameter value $R(t_j)$, the difference

15   between said actual control parameter value $A(t_i)$ and said optimal control parameter value $R(t_i)$, and the difference between said actual self-care values $C_M(t_i)$ and said optimal self-care values $O_M(t_i)$.

20 26. The method of claim 23, further comprising the steps of determining a value of a physiological parameter of a patient and determining at least one of said scaling factors from said value of said physiological parameter.

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27. The method of claim 26, wherein said physiological parameter is selected from the group consisting of a body mass, an insulin sensitivity, a metabolism rate, and a fitness level.

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28. The method of claim 23, wherein said disease control parameter comprises a blood glucose level.

29. The method of claim 28, wherein at least one of

35   said patient self-care parameters is selected from the group consisting of a food exchange, an insulin dose, and an exercise duration.

5 30. A method for predicting in a simulation system an effect
       of patient self-care actions on a disease control
       parameter such that a future disease control parameter
       value $X(t_j)$ at time t_j is determined from an actual
       disease control parameter value $A(t_i)$ at time t_i based on
10   an optimal control parameter value $R(t_j)$ at time t_j, the
       difference between said actual disease control parameter
       value $A(t_i)$ and an optimal control parameter value $R(t_i)$
       at time t_i, and a set of differentials between patient
       self-care parameters having patient self-care values
15     $S_M(t_i)$ at time t_i and optimal self-care parameters having
       optimal self-care values $O_M(t_i)$ at time t_i, said
       differentials being multiplied by corresponding scaling
       factors K_M, said simulation system comprising a memory, a
       processor connected to said memory, a display connected
20   to said processor, and an input means for entering in
       said processor said actual disease control parameter
       value $A(t_i)$ and said patient self-care values $S_M(t_i)$, said
       method comprising the following steps:

       a) storing in said memory said optimal control parameter
25   values $R(t_i)$ and $R(t_j)$, said optimal self-care values
           $O_M(t_i)$, and said scaling factors K_M;

       b) entering in said processor said actual disease control
           parameter value $A(t_i)$ and said patient self-care
           values $S_M(t_i)$;

30   c) calculating in said processor said future disease
           control parameter value $X(t_j)$; and

       d) displaying said future disease control parameter value
           $X(t_j)$ on said display.

35 31. The method of claim 30, wherein said future disease
       control parameter value $X(t_j)$ is calculated according
       to the equation:

       $$X(t_j) = R(t_j) + (A(t_i) - R(t_i)) + \sum_M K_M(S_M(t_i) - O_M(t_i)).$$

32. The method of claim 30, further comprising the steps of entering in said processor an actual control parameter value $A(t_j)$ at time t_j and actual self-care parameters having actual self-care values $C_M(t_i)$ at time t_i and adjusting said scaling factors K_M based on the difference between said actual control parameter value $A(t_j)$ and said optimal control parameter value $R(t_j)$, the difference between said actual control parameter value $A(t_i)$ and said optimal control parameter value $R(t_i)$, and the difference between said actual self-care values $C_M(t_i)$ and said optimal self-care values $O_M(t_i)$.

33. The method of claim 30, further comprising the steps of determining a value of a physiological parameter of a patient and determining at least one of said scaling factors from said value of said physiological parameter.

34. The method of claim 33, wherein said physiological parameter is selected from the group consisting of a body mass, an insulin sensitivity, a metabolism rate, and a fitness level.

35. The method of claim 30, wherein said disease control parameter comprises a blood glucose level.

36. The method of claim 35, wherein at least one of said patient self-care parameters is selected from the group consisting of a food exchange, an insulin dose, and an exercise duration.

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